ROBOT HAVING MULTIPLE DEGREES OF FREEDOM

Abstract of the Invention

An improvement is set forth in a robotic arm structure which includes at least two links. θ motion is provided about a primary axis at the proximal end portion of the proximalmost of the links. R motion proceeds radially from the primary axis whereby the distal end portion of the distalmost of the links can be moved in a radially extending straight line. An end effector is pivotally mounted for rotation relative to the distal end portion of the distalmost link about an end effector axis which is parallel to the primary axis. The structure is improved by adding one or more of a yaw motor, a roll motor and a pitch motor for rotating the wrist of the arm about the respective axes. A sensor array senses the R, θ, Z and yaw, roll and/or pitch motions and creates and transmits electronic signals representative thereof to a computer controller which monitors and controls the R, θ, Z and yaw, roll and/or pitch motions. Non-radial straight line motion and indeed, in certain embodiments any desired three-dimensional motion, is thereby enabled as is picking up of workpieces such as semiconductor wafers, flat panel displays and data storage disks, which are misaligned in cassettes or at workstations and/or are in cassettes which are misaligned and/or aligned and set up at an angle relative to the usual plane of operation of the arm.